MULTIMEDIA UNIVERSITY
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STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

ECP2046 – COMPUTER ORGANIZATION & ARCHITECTURE

(TE, RE, BE)

05 MARCH 2018
02:30 PM – 04:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This booklet consists of 4 pages including cover pages with 4 questions only.
2. Attempt **ALL** questions given. All questions carry equal marks and distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. All necessary working **MUST** be shown.

Question 1

(a) State and discuss THREE main objectives of operating system (OS). [6 marks]

(b) Consider a computer that uses a simple batch system OS that need to execute a program to perform a read and write of a record of data from and to a file. The time taken to read and write a record is 20μs, while the average instruction execution speed is 0.01μs/instruction. Given total number of instruction is 200 instructions:

(i) Calculate the percentage of CPU utilization. [3 marks]

(ii) Discuss the problem of simple batch system. [2 marks]

(iii) How multiprogramming is able to solve the problem of simple batch system and what is its principal objective? [4 marks]

(c) Describe FOUR categories of scheduling techniques. [8 marks]

(d) What is the difference between a page and a segment? [2 marks]

Question 2

(a) (i) Express the negative value -22_{10} as a twos complement binary number, using:

a) 8 bits. [2 marks]

b) 16 bits [2 marks]

c) 32 bits. [2 marks]

(ii) With respect to your answer in Question 2 (a)(i), what can be concluded about the properties of sign extension pertaining to twos complement representation? [2 marks]

(b) The following binary numbers are 4-bit twos complement binary numbers. Which of the following operations (if any) generate overflow? Justify your answers by translating the operands and results into decimal.

(i) 1000 + 1110 [3 marks]

(ii) 0011 + 1100 [3 marks]

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(c) Write the decimal equivalents for these IEEE floating point numbers.

(i) 0 01111111 00000000000000000000000 [3 marks]

(ii) 1 01111110 10000000000000000000000 [3 marks]

(d) Carry out the following arithmetic operations using the *pencil-and-paper* approach by taking the operands as twos complement number:

1110_2 (*multiplicand*) $\times$ 0101_2 (*multiplier*) [5 marks]

Question 3

(a) Answer the following questions about the elements of a machine instructions:

(i) Explain the function of a source operand and result operand. [2 marks]

(ii) Describe any TWO areas in which source and result operands are located. [4 marks]

(b) List and elaborate TWO main factors that influence the design of an instruction set. [4 marks]

(c) With the aid of diagram, illustrate the advantage and disadvantage of the direct addressing versus indirect addressing modes. [8 marks]

(d) Figure Q3 shows a simple processor with a single accumulator (AC). The data paths between elements are indicated with termination of control signals labeled as C_i indicated by a circle.

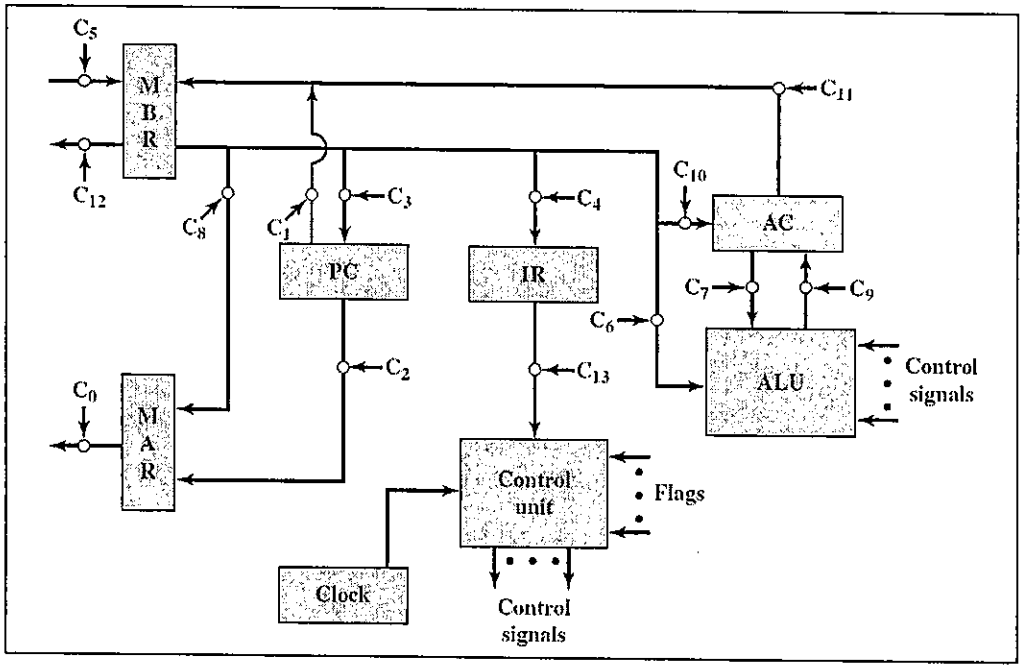

Figure Q3

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Show the micro-operations and control signals for the processor in Figure Q3 for the following instructions:

(i) Store Accumulator [3 marks]
(ii) AND to Accumulator [3 marks]
(iii) JUMP [1 marks]

Question 4

(a) Describe THREE types of hazards in the pipeline. [6 marks]

(b) Answer the following questions:

(i) What is the essential characteristic of the superscalar approach to processor design? [3 marks]

(ii) What is the difference between the superscalar and superpipelined approaches? [3 marks]

(c) Consider the following piece of an assembly language program:

```
I1: MOV  R3, R7
I2: LD   R8, (R3)
I3: ADDI R3, R3, 4
I4: LD   R9, (R3)
I5: BNE  R8, R9, LOOP
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(i) Identify if there are any dependencies can occur during execution. Explain each type of dependency. [11 marks]

(ii) Which of the dependencies that come up during out-of-order execution can be totally eliminated, and suggest a technique that can be used to do so? [2 marks]

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